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IMMOBILIZATION OF ROCKY MOUNTAIN ELK USING POWDERED SUCCINYLCHOLINE CHLORIDE^{1/}

by

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ABSTRACT

After being captured in traps, 78 Rocky Mountain elk (*Cervus canadensis nelsoni*) were successfully immobilized with dry powder charges of succinylcholine chloride during June and July 1971-73. The average dosage was 26.4 mg, with an average latency of 7.1 minutes and duration of 24.5 minutes. There were no significant ($P>0.01$) differences between sexes, age classes, or years for latent period or duration of immobilization. There was a significant difference between 1971-72 and 1973 for amount of drug required. Four drug-related deaths occurred.

Keywords: Rocky Mountain elk, *Cervus canadensis nelsoni*,
drug injection.

^{1/}This paper is an outgrowth of a cooperative study between the Oregon Wildlife Commission (Pittman-Robertson Project W-70-R) and the U.S. Department of Agriculture, Forest Service, Pacific Northwest Forest and Range Experiment Station.

INTRODUCTION

The neuromuscular blocking action of succinylcholine chloride was reported by Castillo and DeBeer (1950). The use of succinylcholine chloride in aqueous solution to immobilize Rocky Mountain (*Cervus canadensis nelsoni*) and Roosevelt (*Cervus canadensis roosevelti* Merriam) elk has been reported by Flook et al. (1962) and Harper (1965). Preloaded darts containing powdered succinylcholine chloride eliminate refrigeration and the time-consuming job of mixing and loading fresh darts each day with various combinations of liquid drug and sterile water.

Our purpose is to report data on doses of powdered succinylcholine chloride suitable for immobilizing Rocky Mountain elk.

METHODS

Rocky Mountain elk from the Blue Mountains of northeast Oregon were captured in panel traps during June and July 1971-73. Traps were checked daily and captured elk immobilized before ear tags and transmitters were attached. Powdered succinylcholine chloride was administered by darts (Pneu-Dart Model No. P1) fired from a CO₂-powered rifle (Pneu-Dart Model No. 167).^{2/} Mechanics of the Pneu-Dart have been described by Liscinsky et al. (1969). Darts used in this study contained from 10 to 30 mg of drug. Trapped elk were cautiously approached on foot, downwind, to minimize disturbance and shot in the hip or shoulder at a distance of 20 feet or less. Elk were usually immobilized with a single dart, but on occasion, two or more darts were necessary to obtain the desired dosage.

Each animal was ranked in one of three categories depending upon the degree of immobilization. Category I animals were incompletely immobilized, remained recumbent, and needed restraint. Elk in category II were immobilized, unable to move, and exhibited no distress. Those in category III were immobilized and exhibited distressed breathing, heart pounding, and no eye control.

RESULTS AND DISCUSSION

Powdered succinylcholine chloride can be successfully used to immobilize Rocky Mountain elk. During three trapping seasons, 78 elk were immobilized. Complete data were collected on 74 elk (table 1)--61 elk were successfully immobilized with a single dart and 17, with two or more darts.

In 1971, the initial dosage selected was 16 mg, following the recommendations of Harper (1965) and Flook et al. (1962), but this dosage proved unsatisfactory. Flook et al. noted that some elk tolerated much heavier dosage rates than others of the same sex-age class. Harper made no attempt to estimate weights because the dosage was not altered in relation to the size of the elk. We found dosage based on sex, age, and weight unsatisfactory because of the variability between animals. More predictable results were obtained by shooting all elk with a minimum 20-mg dosage.

^{2/}Mention of product by name does not imply endorsement by the U.S. Forest Service.

Table 1.--Quantity of succinylcholine chloride used, latent time, and duration time related to immobilization

Sex and age	Number	Drug	Range	Latency	Duration
- - - Milligrams - - - - - Minutes - - -					
Males (12-14 months)	24	26.03(7.23)	12-40	7.6(2.77)	16.3(16.79)
Females (12-14 months)	24	22.33(10.58)	16-40	5.7(4.50)	25.6(9.86)
Females (2-10 years)	26	27.73(10.97)	20-40	7.3(3.24)	31.5(16.76)
All elk	74	26.44(10.26)	12-40	7.1(3.76)	24.5(15.82)

Note: Standard deviation in parentheses.

Ten elk failed to immobilize and were shot with a second dart following a time lapse of 30 minutes to 3 hours. A time delay of this range proved undesirable because two elk died, and eight were never immobilized. The best procedure was to meet or slightly exceed the required dosage with the initial shot as opposed to using two or more darts, separated by a time lag, to achieve immobilization. However, when a second dart was required, we found the time interval between darts should be less than 15 minutes. Fourteen elk shot with a second dart within 10 to 15 minutes were satisfactorily immobilized. Criteria for developing this method were based on the symptoms exhibited by drugged animals. Elk given a proper dosage would exhibit a sequence of symptoms after 3 minutes that terminated with immobilization after about 7 minutes (table 1). If at the end of 10 minutes the symptoms had not developed, we found a second shot of a lower dosage would promote immobilization. The symptoms used to judge the effectiveness of the first shot were (1) urination within 1 to 2 minutes, (2) open

mouth, saliva on lips, heavy breathing at 3 to 4 minutes, and (3) muscle spasms beginning with the front shoulders in 5 to 6 minutes. Rarely would an elk exhibit none of these, yet succumb to the drug.

Of the 78 elk immobilized, five deaths occurred. One adult cow fell on a precipitous sidehill immediately after leaving the trap and died from a broken neck. Another adult cow died within 2 minutes from a 20-mg dosage; dart placement near an arterial blood supply was thought to be the cause. Three delayed mortalities, two adult cows and one yearling bull, occurred. One adult female given 20 mg appeared to have recovered after 70 minutes. She stood for 5 minutes, lay down for 23 minutes, rose, and left the trap exhibiting complete coordination. Her skeleton and collar were found 200 yards from the trap 1 year later. The other two elk died within 24 hours. An adult cow shot with two darts (each containing 20 mg) 30 minutes apart and a yearling bull shot with a 16-mg dart never regained sufficient body coordination to stand.

In 1973, the average dosage was 34.7 mg or almost double the average dosage of 19.4 mg used 1971-72. A similar experience with liquid succinylcholine chloride was reported by Craighead et al. (1973). We have no explanation for this other than the difference in efficiency of the drug between years. The latent period ranged from 2 to 21 minutes and averaged 7.1 minutes. Increasing the dosage did not significantly ($P>0.01$) affect the latent period. There were no significant ($P>0.01$) differences in the latent period between the sex and age of animals or between years. Duration of immobilization ranged from 2 to 70 minutes and averaged 24.5 minutes. There were no significant differences ($P>0.01$) for duration of immobilization between sex, age class, or years.

Of the elk immobilized, 53 percent were ranked in category II, the most desirable state; 26 percent were ranked in category III, the least desirable state; and 22 percent were ranked in category I. In this state the animal could be restrained to complete tagging, but recovery was unpredictable and sometimes untimely.

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